FOCUSING ON THE CRITICAL NEEDS OF THE WARFIGHTER

While the traditional focus of the Air Force Research Laboratory (AFRL) has been on developing long-term capabilities, AFRL is also proactive in answering the current needs of our troops deployed in hostile areas. Working closely with operational users, AFRL scientists and engineers are able to identify, develop, and rapidly transition the technologies to dominate both traditional and asymmetrical threats.

PREPARING THE WARFIGHTER FOR THE CURRENT THREAT

Visual Threat Recognition and Avoidance Trainer (VTRAT)

Air Force Special Operations Command (AFSOC) aircraft scanners identify antiaircraft threats, direct the pilot in performance of evasive maneuvers, and deploy countermeasures during an antiaircraft threat engagement. AFSOC recognized the need for an advanced training device. The Information Systems Training Branch of the Human Effectiveness Directorate developed the VTRAT in response to their need. Scientists designed VTRAT to train scanners on their duties during various antiaircraft threat engagements. The simulation displays visual characteristics of antiaircraft weaponry, such as missile fly-out and antiaircraft artillery rate-of-fire, as seen from the scanner's viewpoint in the aircraft. Directorate scientists worked closely with subject matter experts to tailor VTRAT to specific aircraft tactics and individual crewmember responsibilities. Prior to deployment in Operation ENDURING FREEDOM (OEF) and Operation IRAQI FREEDOM (OIF), AFSOC, Air Force Reserve Command, and Air National Guard crews received VTRAT training. After deployment, warfighters praised VTRAT as a valuable and accurate tool that was extremely helpful in immediately identifying the enemy threat.

Counterfatigue Strategies Enhance Performance During Sustained Operations

Scientists from the Human Effectiveness Directorate's Warfighter Fatigue Countermeasures (WFC) program conducted wartime aircrew fatigue assessments and operational consultations in support of OEF and transitioned the strategies and technology to support operations in OIF. One such transition involved sustained B-52 operations. Prior to their initial OIF missions, the 2nd Operations Group requested counterfatigue strategies and recommendations from the WFC Team for anticipated 30+ hour missions. The WFC Team, working closely with flight surgeons from the operations group, used the Fatigue Avoidance Scheduling Tool to prescribe the use of pre-mission crew rest, strategic naps, and pharmaceutical alertness enhancers to provide counterfatigue strategies for these global missions.

Improved Laser Eye Protection (LEP)

During OEF, the Air Combat Command (ACC) identified an immediate need to expedite increased laser protection for aircrews. The LEP Team, of the Human Effectiveness Directorate, rapidly responded with improved LEP. The new design protects against a second visible threat wavelength in addition to the protection provided by the previously fielded LEP devices. Within a month, the directorate team collated, analyzed, and delivered results of laboratory data to the 311th Human Systems Wing Program Office (HSPO). The scientific data was of such quality that the HSPO immediately issued a provisional safe-to-fly (STF) recommendation while final aircrew in-flight evaluations were accomplished. The LEP Team proceeded to final simulator, ground, and in-flight evaluations of the improved LEP with C-17 and F-15E aircrews. The unrestricted STF recommendation was received only 3 months after the final go-ahead from ACC.

EQUIPPING THE WARFIGHTER TO TRANSFORM THE BATTLESPACE

Battlefield Air Operations (BAO) Kit

Special tactics combat controllers behind enemy lines use the BAO Kit to identify and locate targets and then transmit the data to the air operations center for target approval and relay to the strike aircraft. AFRL scientists, assigned to the BAO Kit program, evaluated the use of off-the-shelf laptops, wireless networks, image compression algorithms, and small camera-equipped unmanned air vehicles to enhance both ground and aircrew situational awareness and engage time-critical targets. Additional development spirals are under way to increase communications, situational awareness, and flexibility through the removal of cables, and for additional use of small unmanned air vehicles for targeting. AFRL has a continuing program performed jointly by five of its directorates (Sensors, Human Effectiveness, Information, Munitions, and Propulsion) to develop and apply their latest technologies cohesively toward a well-integrated, next-generation BAO capability.

Integrated Panoramic Night Vision Goggles (IPNVG)

The Human Effectiveness Directorate's IPNVG system provides aircrew members with increased viewing and unsurpassed situational awareness at night, offers protection from lasers, and causes less neck fatigue during long missions. Night vision goggles offer tactical advantages in both air and ground arenas, but the currently fielded system provides only a limited 40° circular field of view (FOV). The IPNVG's intensified 95° FOV significantly improves night navigation, targeting, weapons delivery, and search and rescue. The IPNVG integrates laser-hardening technology and accommodates prescription and laser eyewear. The design also eliminates maintenance requirements, such as nitrogen purging, and incorporates numerous maintenance-friendly elements.

First Response Expeditionary (FRE) Fire Vehicle

Materials and Manufacturing Directorate engineers developed a deployable, lightweight vehicle that provides crash and rescue firefighting capability in a variety of mission profiles. The FRE fire vehicle, developed to meet Air Combat Command and civil engineering requirements, established its value during OIF when several of the units were deployed to protect helicopters, aircraft, tent cities, and other bare base operations. The FRE fire vehicle, developed to bridge the gap between flight line fire extinguishers and full-sized crash and rescue fire trucks, is ideal for small aircraft and helicopter crashes, for hot pit refueling, and for tent city or deployed base fire protection. The vehicle can be operated with minimal training or experience, is virtually maintenance free, and is adaptable to a wide variety of mission profiles and vehicle platforms. In addition, the FRE vehicle is sized to occupy minimal pallet space on a cargo aircraft.

PROVIDING WEAPONS AND EXPERTISE TO ACHIEVE TACTICAL DOMINANCE

Massive Ordnance Air Blast (MOAB)

Besides being the largest non-nuclear weapon in the arsenal, the MOAB is also a testament to AFRL's responsiveness. In order to meet the extremely aggressive schedule supporting MOAB's availability for operational deployment, Munitions Directorate managers put together a multidisciplined team to take the system from a completed design through production, development, flight-testing, and limited deployment in 12 weeks. Engineers designed the 21,700 lb precision-guided weapon to be dropped from a C-130 aircraft. The weapon is strapped to a cradle that separates upon extraction from the aircraft. Two fixed wings provide aerodynamic lift to extend the range and launch envelope of the weapon. Another unique aspect of the MOAB design is the incorporation of lattice fins for aerodynamic control. The retractable lattice fins provide the large surface area necessary to control the weapon and allow the MOAB to fit in a C-130 cargo bay.

C-17 Airdrop

The C-17 Globemaster, with its high weight and compact wingspan, generates strong wake turbulence. Flight tests of the C-17 revealed two problems that could severely limit its personnel airdrop capability. The first problem, center-lining, could occur if paratroopers exited the left and right side doors simultaneously. As they are drawn into the aircraft wake, they could collide beneath the aircraft, or their parachutes could become entangled. The second problem, vortex encounter, could occur if paratroopers fell through a wingtip vortex generated by an aircraft upstream in the formation. This could result in a collapse of the parachute canopy. Air Vehicles Directorate scientists created computational models of the C-17 and investigated changes in flight procedures that would mitigate the problems. Extensive flight tests were conducted with both mannequins and live troops that demonstrated the safety of the revised flight procedures. This work led to the first combat airdrop using the C-17, when 15 aircraft dropped 1000 troops from the 173d Airborne Brigade and their equipment into Northern Iraq, securing the Northern Front.

Passive Attack Weapon (PAW)

The PAW is a modified Wind Corrected Munitions Dispenser (WCMD) packed with 3700 nonexplosive kinetic energy penetrator rods. The objective of the PAW program was to develop and flight demonstrate a weapon capable of defeating a wide variety of surface targets with minimal collateral damage. Some examples are storage facilities, fuel depots, power substations, and urban combat targets. In designing the PAW, Munitions Directorate engineers employed existing systems wherever possible to maintain the same shape and weight as existing WCMD weapons. This design philosophy saved the cost and time required to certify the weapon for aircraft carriage and delivery, train the load crews, and teach the aircrew how to deliver it. The collaborative effort of the directorate and other operational units at Eglin Air Force Base proved that the immediate needs of the warfighter could be accommodated—in this case, in less than 180 days!

INTEGRATING TECHNOLOGY TO CONTROL THE BATTLESPACE

Joint Targeting Toolbox (JTT)

The Information Directorate's JTT is the single Department of Defense system for management and dissemination of targeting data. JTT provides decision makers at all echelons with a common targeting picture of the battlespace. During OIF, US Central Command used the new JTT tool exclusively to manage and coordinate critical no strike lists across service components and with international coalition partners. The Interim Targeting Solution application within the JTT architecture collected and disseminated post-mission reporting information to the Web, which was critical to coalition battle damage assessments.

Web-based Timeline Analysis System (WebTAS)

The WebTAS, developed by the Information Directorate, is operational at numerous intelligence sites and is heavily used in the global war on terrorism. WebTAS provides the most complete picture of the battlespace in the theater. The system provides a temporal picture from multiple data sources and displays the data in common maps, timelines, and situation-alerting tools. It replaces the manual correlation of information previously used by the air operations center. WebTAS is operational at Special Operations Command Central Headquarters and forward locations in support of OEF and OIF.

Weapon Systems Global Positioning System (GPS) Jamming Evaluated Prior to Conflict

The Sensors Directorate was asked to evaluate the performance of various weapon systems in the presence of GPS jamming before the start of OIF. Directorate engineers interfaced the GPS Interference And Navigation Tool (GIANT) with the Antenna Wavefront Simulator to provide a virtual flight test (VFT) environment to support the evaluation and generate measures of effectiveness for each weapon system. Potential system problems were identified, and GPS experts formulated solutions prior to combat. The GIANT simulation and the VFT test results correlated, to a high degree, with GPS performance during actual combat operations.

SUMMARY

Maintaining our technological advantage requires us to develop technologies and expertise to support a broad range of capabilities. Operations ENDURING FREEDOM and IRAQI FREEDOM have underscored the need for AFRL to work collaboratively with the warfighter to provide decisive capability in today's conflicts, while investing in an array of new technologies to affect the outcome of future hostile encounters.

Leveraging Technology to Dominate the Battlespace

AFRL has provided a host of other technological solutions to warfighter needs in OIF and OEF. This brochure and information on these additional contributions can be found on the web at: http://www.afrl.af.mil/specint.htm

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